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Introduction to Theoretical Time Travel

from *Time Life* books

Time-Travel is easy. All of us do it every day. But only in one direction. For thousands of years, scientists and philosophers have talked of time as a "river that flows steadily onward year-after-year". But what if there were a way to swim against the flow? Or to run down the bank ahead of the river? Might we might be able to journey back-and-forth in time just as we travel through space. The idea is not as far-fetched as it sounds. And the implications for the future are intriguing.

1895	British author H.G. Wells publishes <u>The Time Machine</u>
1905	Albert Einstein's <i>Special Theory of Relativity</i> shows that space and time are "relative" -- <u>not</u> absolute -- and that time is actually a 4 th dimension within what he calls " <i>space-time</i> ".
1916	Einstein discovers that space-time is <u>curved</u> .
1937	Mathematician Kurt Goedel proposes that the Universe itself may be a time machine.
1949	Goedel demonstrates mathematically that pathways through time are possible .
1967	U.S. physicist John Wheeler invents the name " black hole " to describe singularities in space and time. (<i>Wheeler also co-developed the Everett/Wheeler 'Many Worlds' quantum-based theory of parallel universes and time lines.</i>)
1974	Astrophysicist Frank Tipler plots paths around a vast, imaginary spinning cylinder, confirming that paths though time <u>can</u> exist!
1985	The movie " <i>Back to the Future</i> " is released.
1988	Caltech University's Kip Thorne (<i>in a reply to Carl Sagan who was writing his novel "Contact"</i>) proves that under the <u>right conditions</u> , " wormholes " can be used as a possible means of time-travel.
1991	Richard Gott at Princeton University proves that " <i>cosmic strings</i> " could be used for time travel.

Super-Science , NOT Fantasy!

Ever since **Einstein**, scientists have considered time and 3-dimensional space not as 2 different things but as different aspects of a 4-dimensional "**space-time**". Quantum physicists(who study the world of subatomic particles) often find it easier to explain events by assuming time runs backward as well as forward despite however much it defies common sense.

At the other extreme, cosmologists looking at the Universe on a grand scale have found that **space and time can be warped by gravity and speed**. Back in the 1940s, German mathematician **Kurt Goedel** proved that if we could warp and twist space-time enough -- creating what he called "Closed, Time-like Curves (CTC)" -- then we could **bore tunnels through time itself**. But no one knew how to do the twisting. Until **black holes**.

The gravitational pull of a black hole is so enormous that it distorts the very fabric of space-time into what is called a **singularity**. When singularities were found to spin, it was proved that Closed, Time-

like Curves not only can occur -- they MUST occur! The singularity forms a doughnut shape in space-time while the hole in the middle is a perilous gateway to somewhere -- or when. **[StealthSkater note: while the implications to CTCs may still be preserved, newer models of black holes offer a Gravastar to replace the point-like singularity of infinite density. For further information, go to [doc](#) [pdf](#) [URL](#)]**

3 Ways to Travel in Time Without Breaking the Rules

1. Wormholes

Since the 1930s, physicists have speculated about the existence of "wormholes" in the fabric of space. Wormholes are essentially gateway between different parts of the Universe and are made by **linking a pair of black holes**. This effectively creates a **tunnel** through time and space: a traveler entering at one end would exit the other at a different time as well as a different place.

The difficulty lies in keeping the wormhole open while the traveler makes his journey. If the opening snaps shut, he will never survive to emerge at the other end. For years, scientists believed that the transit was physically impossible. But recent research -- especially the U.S. physicist **Kip Thorne** -- suggest that it could be done using *exotic materials* capable of withstanding the immense forces involved. Even then, the time machine would be of limited use.

For example, you could not return to a time before the wormhole was created. Using wormhole technology would also require a society so technologically advanced that it could master and exploit the energy within black holes. But the trip would NOT be impossible -- just very, very difficult!

2. Rotating Cylinder

Civilizations with the technology to harness black holes might be better advised to leave wormholes and try the time-warp method suggested by U.S. astronomer **Frank Tipler**. He has a simple recipe for a time machine. First, take a piece of material 10 times the mass of the Sun. Then squeeze it together and roll it into a long, thin, super-dense cylinder (a bit like a black hole that has passed through a spaghetti factor). Lastly, spin this cylinder at a few billion revolutions-per-minute and see what happens.

Tipler predicts that a ship following a carefully plotted spiral course around the cylinder would immediately find itself on a "Closed, Time-like Curve". It would emerge thousand -- even billions -- of years from its starting point and possibly several galaxies away.

There are problems, though. For the mathematics to work properly, Tipler's cylinder has to be infinitely long. Also, odd things happen near the ends, and you need to steer well clear of them in your time-ship. However, if you make the device as long as you can and stick to paths close to the middle of the cylinder, you should survive the trip!

3. Cosmic Strings

As a variation on the rotating cylinder, some scientists have suggest using "**cosmic strings**" to construct a time machine. At the moment, these are purely theoretical objects that might possibly be left over from the creation of the Universe in the Big Bang.

A black hole contains a one-dimensional singularity -- an infinitely small point in the space-time continuum. A cosmic string, if such a thing existed, would be a 2-dimensional singularity -- an infinitely thin line that has even stranger effects on the fabric of space and time.

Although no one has actually found a cosmic string, astronomers have suggested that they may explain strange effects seen in distant galaxies. By maneuvering two cosmic strings close together -- or possibly just one string plus a black hole -- it is theoretically possible to create a whole array of "closed timelike curves". Your best bet is to fire two infinitely long cosmic strings past each other at very high speeds, then fly your ship around them in a carefully calculated figure-eight. In theory, you would be able to emerge **anywhere, anytime!**

What If Tourists From the Future Could Visit Us ?

If time machines are possible, it is likely that someone in the Future will already have constructed one. After all, in the Future there is time to complete even the largest engineering project! Even if humans are not up to the task, creatures from other planets may try. So why are we not overrun by visitors from the Future?

This is the argument used by the famous English physicist **Stephen Hawking** in what he called his "**Chronology Protection Conjecture**". Like many other scientists, Hawking is troubled by the weird paradoxes of time-travel. He argues that the Universe simply couldn't allow time-travel to happen because its evolution since the Big Bang cannot be reversed. If the Universe were to contract instead of expanding, asks Hawking, would human beings "un-evolve" in the same way as they have evolved over millions of years?

A second explanation for the absence of visitors envisaged so far lets the voyager go back before the moment the machine was first constructed. So relax. Since no one has built a time machine yet, out-of-time tourists are not a problem! **[StealthSkater note: not all physicists agree with Hawking on this accord. Even famed German rocket scientist Hermann Oberth opted that the UFOs he was "privileged" to study behaved more like "time machines" than normal 3-dimensional-traversing craft (see [doc](#) [pdf](#) [URL](#) . Also "time" may take on different meanings. Read Tom Skegg's 'Star Chamber' essays at [doc](#) [pdf](#) [URL](#)]**

Technical limitations aside, the Everett/Wheeler "**Many Worlds Interpretation**" also solves most of the paradoxes of time-travel ([doc](#) [pdf](#) [URL](#)). According to this (so far un-refuted by mathematics) theory, an infinity of universes is constantly being created. In quantum physics when subatomic particles have a "choice" of options (such as going through one hole or another in a screen), they select one at random. The "Many Worlds" theory says that there is a universe for each possible choice made by the particle. Many of these universes are unstable and collapse back into the "quantum foam" shortly after their creation. **[StealthSkater note: Mr. Skeggs' 'Star Chamber' is based on this 'Many Worlds' which permits one's consciousness to be projected to any point in time and space and allowed to interact in real-time as a holograph. Something similar may have occurred in the Montauk Project legend. Although both of these allege non-physical time-travel, the Philadelphia Experiment may have accidentally tricked Mother Nature into allowing the Eldridge to behave as a quantum particle and therefore achieve Macroscopic Quantum Tunneling. This is what UNITEL proposes for their quantum-laser interstellar craft at [doc](#) [pdf](#) [URL](#)]**

"Many Worlds" solves another of the famous time-travel paradoxes. Say you went back in time and shot your grandfather before he met your grandmother. Would you never have been born? If not, you could never have traveled back in time and shot your grandfather. Which means there you were born, so

you could have gone back. According to "Many Worlds", when you go back in time, you actually emerge in another universe that develops in parallel to our own (as in the TV series "**Sliders**"). But with an infinity of universes to choose from, how can time-travelers ever hope to find their way back to the one they started out from?

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